

Memorandum

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To: ALL DISTRICT DIRECTORS
Attention: Deputy District Director for Project Management
Deputy District Director for Planning
Deputy District Director for Design
Deputy District Director for Maintenance & Operations
CHIEF, DIVISION OF TRANSPORTATION PLANNING
ALL HOLDERS OF THE HIGHWAY DESIGN MANUAL
ALL HOLDERS OF THE TRAFFIC MANUAL

Date: October 3, 2003

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Subject: Revised Design Information Bulletin 80 - Roundabouts

This transmittal memorandum provides notice that the above-referenced revised Design Information Bulletin (DIB) is now available on the Division of Design website (<http://www.dot.ca.gov/hq/oppd/dib/dibprg.htm>). The updated version of DIB 80 shall be referred to as DIB 80-01 and is effective as of October 3, 2003. DIB 80-01 supersedes DIB 80. Projects, where project development efforts have started, shall comply with HDM Index 82.5 (Effective Date for Implementing Design Revisions to Design Standards).

The modern roundabout is now recognized nationally as an intersection type and traffic control treatment capable of providing unique and significant operational and safety benefits over a wide range of traffic volumes and conditions. In particular, national research has confirmed that the single-lane version is especially effective in reducing collision frequency and/or severity for all highway users.

Districts are encouraged to consider the roundabout as a strategy or countermeasure to optimize intersection safety and operations. Therefore, Planning, Design, and Traffic Operations personnel should become familiar with the guidance provided in this DIB to ensure that roundabouts are selected, designed, and analyzed appropriately in combination with all other departmental policies.

BACKGROUND

The Divisions of Design and Traffic Operations co-chartered a Roundabout Task Force to evaluate the state-of-the-practice for roundabouts. The Task Force has completed their work and the results of their evaluation have been incorporated into DIB 80-01. DIB 80-01, including Attachment A and the FHWA publication - *Roundabouts: An Informational Guide* (Guide) dated June 2000, provide state-of-the-practice guidance based upon national and international research and experience.

SUMMARY OF KEY CHANGES AND CONCEPTS

- DIB 80-01 supersedes the previously published DIB 80 dated September 8, 1998.
- The Federal Highway Administration (FHWA) publication, *Roundabouts: An Informational Guide* (Guide) dated June 2000, with the exceptions noted in DIB 80-01 and Attachment A, is to be used as the primary source of technical guidance for the evaluation and development of roundabout proposals.
- Operational and geometric features that do not conform to the practices, or the range of criteria described in the Guide require approval of the Traffic Operations Liaison and the Design Coordinator.
- Conceptual approval of roundabouts is now consistent with the process used to reach engineering decisions on the need for, and type of intersection traffic control system (e.g., traffic signals). Early consultation with the Traffic Operations Liaison and the Design Coordinator is recommended to discuss the proposed use of a roundabout and to define the analysis and documentation needed to support each request for approval. Their joint written approval is required for conceptual approval.
- Roundabouts need to be evaluated and designed on a case-by-case basis taking into consideration the physical characteristics of the location, the orientation of the approaches to the circular intersection, the existing and proposed intersection operating conditions, plus the safety and mobility needs of all motorists, bicyclists, and pedestrians that will be using the facility.
- Roundabouts are a relatively new type of intersection and in many communities the public may not be knowledgeable of their utility and benefit. Therefore, early public participation and, as appropriate, public education campaigns should be considered with each roundabout project.

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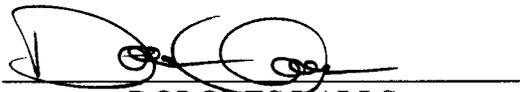
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DESIGN INFORMATION BULLETIN NUMBER 80-01

**California Department of Transportation
Division of Design
Office of Geometric Design Standards**

ROUNDABOUTS

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October 3, 2003

ROUNDABOUTS

1.0 Policy

Each proposal for a roundabout intersection on the State Highway System shall be developed and evaluated in accordance with the Federal Highway Administration's (FHWA's) technical publication, *Roundabouts: An Informational Guide* (Guide) dated June 2000 and this California Department of Transportation (Department) Design Information Bulletin (DIB). This version, DIB 80-01, supersedes the previously published DIB dated September 8, 1998.

To promote a consistent approach to the selection, design and operation of roundabout intersections, all proposals are subject to the evaluation and approval requirements presented in Section 5.0 - Approvals.

2.0 Background

Roundabouts are circular intersections that feature, among other important geometric components, a central island, a circulatory roadway, and splitter islands on each approach.

The use of modern roundabouts in the United States began in the early 1990's, and their popularity has continued to grow. This DIB is intended to provide assistance in ensuring their proper use on the State Highway system.

Key to the proper implementation of these facilities is the understanding that roundabouts rely upon two basic and important principles:

- 1) Speed reduction through the facility, achieved through geometric design, which ensures optimal operational benefits and safety enhancement; and,
- 2) The yield-at-entry rule, which requires traffic entering the intersection to yield to traffic that is traveling in the circulatory roadway when conflicts occur between them.

3.0 Applications

Use of roundabouts on the State Highway system may be considered for the primary purpose of enhancing safety and operational characteristics at intersections. Chapter 3 of the Guide discusses locations and situations that may lend themselves to roundabout installation, and the potential benefits that may be realized. Benefits may include safety improvements, intersection capacity improvement, and an overall betterment in operational characteristics of the intersection.

Chapter 3 of the Guide also communicates factors which may significantly influence the design of a roundabout, and may, in some cases, lead to a decision that a roundabout is not a viable alternative for a given location. Planners or engineers may wish to consider measures suggested in Chapter 3 of the Guide that will allow the inclusion of a roundabout among the range of alternatives despite less than optimal circumstances.

4.0 How to use this DIB

Accompanying this DIB is Attachment A, which documents the Department's roundabout design policies that differ from or supersede the text found in the Guide.

This DIB and Attachment A, together with the Guide, are to be used as the current state of the practice for the planning, design, and analysis of roundabouts and roundabout approaches on the State Highway system. The text provided in Attachment A shall govern in every instance where conflicts arise or ambiguities exist between the Guide and the Highway Design Manual (HDM) or the Traffic Manual.

This DIB will be updated periodically as new information and data become available.

5.0 Approvals

To promote a consistent approach to the selection, planning, designing, and operation of roundabout intersections, all proposed roundabouts are subject to the following evaluation and approval requirements.

5.1 Conceptual Approval

For the purposes of this DIB, conceptual approval means that a preliminary determination has been made that a roundabout is a viable alternative for a new or existing intersection on the State Highway system.

To obtain this determination, a roundabout intersection must be recommended by the District and then jointly approved by both the Headquarters Division of Traffic Operations Liaison (Traffic Operations Liaison) and the Division of Design Coordinator (Design Coordinator). This approval is to be documented in writing and will be considered attained upon the signature of both individuals. This process should be completed in advance of any programming of design resources for a roundabout, or for any other similar commitment (such as an Encroachment Permit); or as soon as identified beyond the PID stage, for example, as a Value Analysis recommendation.

Early consultation is recommended to discuss the proposal and to ascertain expectations for the analysis and documentation needed to support each request for approval.

The level of engineering analysis and documentation required prior to conceptual approval must provide a reasonable demonstration of:

1. **Operating Conditions** - either observed or anticipated, within five years after completion of construction, that indicate a need or deficiency which justifies the control of traffic flow and/or speed at the approaches to the intersection.
2. **Potential to Resolve or Improve Operating Conditions** - the potential of the roundabout to resolve or improve the operating conditions identified in Item Number 1 above. For most roundabout proposals, the procedures presented in Chapter 4 of the Guide may be used for operational analysis. If a more detailed

analysis is required, the Traffic Operations Liaison should be consulted for additional guidance on the use and availability of software tools.

3. **Design Period** – the ability of the roundabout to accommodate the design year traffic, normally 20 years after completion of construction. At some locations, a phased implementation may be desirable to optimize performance. However, accommodating the 20-year design traffic must be an integral part of the planning process for a roundabout.
4. **Conformance with Geometric and Operational Design Concepts** - substantial conformance with geometric and traffic design principles, practices, and the range of criteria that collectively produce the optimal speed environment at and through the roundabout. The speed of vehicles through the roundabout has a direct correlation to the overall safety of all motorized vehicles, bicycles, and pedestrians that will be using the facility. The design elements which exert the greatest influence on traffic include:
 - Size of the roundabout (i.e., diameter of the inscribed circle)
 - Position of the roundabout
 - Alignment and arrangement of approach legs

5.2 Approval of Nonconforming Geometric and Operational Features

In order to achieve optimum performance, the various geometric and operational features of a roundabout need to be customized to fit the unique site and traffic conditions that are expected to prevail. As a result, design variations among different roundabouts are not only possible, but also often desirable.

It is important to note that when proposed geometric and operational features do not conform to the practices or the range of criteria described in the Guide or Attachment A to this DIB, a consultation with the Design Coordinator and Traffic Operations Liaison as described in Section 5.1 above is required to discuss the scope of analysis and appropriate documentation that will be necessary to gain approval for each nonconforming feature. This process is applicable during all phases of project development, but should be initiated as soon as it appears likely that a nonconforming feature will be necessary.

6.0 Reference

Roundabouts: An Informational Guide, Federal Highway Administration Report No. FHWA-RD-00-067, U. S. Department of Transportation, Washington, D.C., June 2000.

ATTACHMENT A

California Department of Transportation Supplement to FHWA Report Number FHWA-RD-00-067; *Roundabouts: An Informational Guide*

The following describes the additions to and deviations from the above-referenced FHWA publication, Roundabouts: An Informational Guide (Guide) dated June 2000, that are to be used when designing roundabouts on the State Highway system.

Definition of Roundabout Approach and Intersection

Guide Reference Section: 1.4 Key Dimensions

The Guide defines a number of key dimensions of a roundabout and illustrates and describes them in Exhibits 1-1 through 1-4. The Guide also provides recommendations for defining the “intersection” boundary of the roundabout in Section 2.4.1. For the purposes of design, the areas referred to in the Guide as “approach” and “intersection” shall be as follows:

Table 1 – Roundabout Approach and Intersection Definitions

Feature	Description
Approach	The <i>approach</i> is the segment of roadway used by approaching and/or departing traffic. It is located between the point where the left edge of traveled way diverges from centerline and the limit of the pedestrian crossing farthest from the circle (or 6 m from the inscribed circle if pedestrian crossing is not permitted).
Intersection	The <i>intersection</i> is the area bounded by the limits of the pedestrian crossing areas around the perimeter of a single central island (or 6 m from the inscribed circle if no pedestrian crossing is provided).

Treatment of Pedestrian Crossings

Guide Reference Section: 6.3.7 Pedestrian Crossing Location And Treatments

The Guide allows crosswalks to be placed one, two or three car lengths away from the yield line. However, three car lengths may be excessive at most locations. Therefore, the Department’s policy regarding the 5th bullet of Section 6.3.7 of the Guide shall be as follows:

“At single-lane approaches and departures, the pedestrian crossing should be located one car length (approximately 7.5 m) away from the inscribed circle. At multi-lane approaches and departures, the pedestrian crossing should be located two car lengths (approximately 15 m) away from the

inscribed circle. In all cases, the pedestrian crossing shall be no closer than 6 m from the inscribed circle.”

Correspondingly, Exhibit 6-26 of the Guide, Minimum Splitter Island Dimensions, shall reflect the following modification:

The 7.5 m setback of the crosswalk from the inscribed circle should be labeled “6.0 to 7.5 m.”

Stopping Sight Distance

Guide Reference Section: 6.3.9 Stopping Sight Distance

The Highway Design Manual (HDM) and the Guide are in general agreement as to Stopping Sight Distance (SSD) standards. Table 2 below supersedes Exhibit 6-28 of the Guide and is to be used for roundabout design on the State Highway system.

Table 2 – Roundabout Stopping Sight Distance

Design Speed (km/h)	Roundabout Stopping Sight Distance (m)
10	10
20	20
30	30
40	50
50	65
60	85
70	105
80	130
90	160
100	190

Intersection Sight Distance

Guide Reference Section: 6.3.10 Intersection Sight Distance

The Guide calls for use of the following formula for determining Intersection Sight Distance (ISD):

$$b = 0.278 * (V_{\text{major}}) * (t_c) \quad \text{(Guide Equation 6-3a)}$$

Where:

- b = Length of conflicting leg of sight triangle (in meters)
- V_{major} = Design speed of conflicting vehicle (in km/h)
- t_c = Critical gap (in seconds)

Designers shall use the critical gap value of 6.5 seconds recommended in the Guide as an initial design parameter for the purpose of determining ISD for each approach leg of a roundabout. However, it is essential that the design speed and speed consistency through

the circulatory roadway be checked to ensure that the target speed through the roundabout is accomplished.

If design speed or speed consistency cannot be obtained, modifications to the geometrics should be made to meet the target speed through the circulatory roadway. If the target speed cannot be met in this fashion, the value for the critical gap in the ISD equation may be reduced until the target speed through the roundabout is achieved, or until the minimum critical gap value is reached.

Similarly, right of way issues may preclude attaining the ISD requirements that result with the use of the 6.5-second critical gap value. If, after first making efforts by modifying geometrics, the ISD requirements cannot be achieved without encountering right of way conflicts, reduction in critical gap value may proceed until right of way difficulties cease to exist, or until the t_c minimum threshold is reached.

The minimum critical gap value to be used shall be 5.0 seconds. This minimum threshold is based on studies focusing on critical gap values for U.S. roundabouts.

The Guide states that the length of roadway representing “b” in the equation above is assumed to follow the curvature of the roadway. Figures 1 and 2 are provided for clarification of this concept.

Typical Circulatory Roadway Section

Guide Reference Section: 6.3.11.2 Superelevation

The Guide describes typical cross sections of the circulatory roadway, with and without a truck apron, and illustrates this topic with Exhibits 6-37 and 6-38. While the Guide shows mountable curb at the central island, the Department calls for vertical curb except at rural high-speed locations. Therefore, the last paragraph of Section 6.3.11.2 of the Guide is superseded by the following text. Also, Figure 3 supersedes Exhibits 6-37 and 6-38 in the Guide.

“Figure 3 provides typical cross sections of the circulatory roadway, one without a truck apron and one with a truck apron. Where truck aprons are used, the slope of the apron should be 3 to 4 percent away from the central island; greater slopes should not be used.

Non-mountable curbs should outline the central island, splitter islands and exterior of most roundabouts. At roundabouts in rural high-speed locations, to minimize the impact on inattentive drivers, the central island and splitter islands should be outlined in mountable curb. Truck aprons should be outlined in low non-mountable curb (75-100 mm with 1.5:1 sloped face or steeper) or high mountable curb (100-150 mm with 1:2 sloped face or flatter). This is intended as a deterrent to most vehicles but at the same time is easily mountable by low speed trucks.”

Bicycle Entry Ramp to Shared-Use Path

Guide Reference Section: 6.3.12 Bicycle Provisions

Provisions for bicyclists are discussed in Section 6.3.12 of the Guide and illustrated in Exhibit 6-39. To accommodate bicyclists on the State Highway system who prefer not to use the circulatory roadway, ramps up to enter the shared-use path are to be provided as shown in Figure 4.

Crosswalk Marking

Guide Reference Section: 7.2.2.5 Pedestrian Crosswalk Markings

Pedestrian crosswalk markings are discussed in Section 7.2.2.5 of the Guide. The Guide recommends “zebra” crosswalks. However, to improve the clarification of the crossing for pedestrians, including the visually impaired, the preferred type of crosswalk markings at roundabouts on the State Highway system is the “ladder” type. This configuration has the transverse lines of most common crosswalks in addition to the longitudinal lines of the “zebra” crosswalk.

To improve pedestrian accessibility, detectable warning surfaces must be used at all pedestrian crossings.

Crosswalks shall be marked at roundabouts, including rural locations, on all legs where pedestrians will be crossing. Consult your Traffic Operations Liaison for additional guidance relative to crosswalks at roundabouts.

Delineation of the Circulatory Roadway

Guide Reference Section: 7.2.3 Circulatory Roadway Pavement Markings

In general, lane lines within the circulatory roadway of two-lane roundabouts are not marked. However, special delineation treatments may be considered at specific locations to facilitate or enhance operations that otherwise may be inhibited by non-conforming design features. For example, where physical constraints limit the amount of deflection provided along an approach roadway, more efficient operation may result from some form of lane striping in the circulatory roadway. Consult your Traffic Operations Liaison for additional guidance relative to delineation treatments.

Landscaping

Guide Reference Section: 7.5 Landscaping

The HDM and the Guide are in general agreement as to the functional and aesthetic value of landscaping on the State Highway system. In roundabout design, a landscaped central island reinforces the non-linear layout of a roundabout intersection. Landscaped buffers integrate the facility with the surrounding streetscape as well as encourage pedestrians to cross only at designated crossing locations.

Maintaining sightlines and safety setbacks for trees in the landscape design for a roundabout will require a case-by-case study of roundabout design speed, geometry, capacity, and other factors.

Figure 1
Circulating Stream Conflicting Leg Distance “b”
Described In Equation 6.3 in the Guide

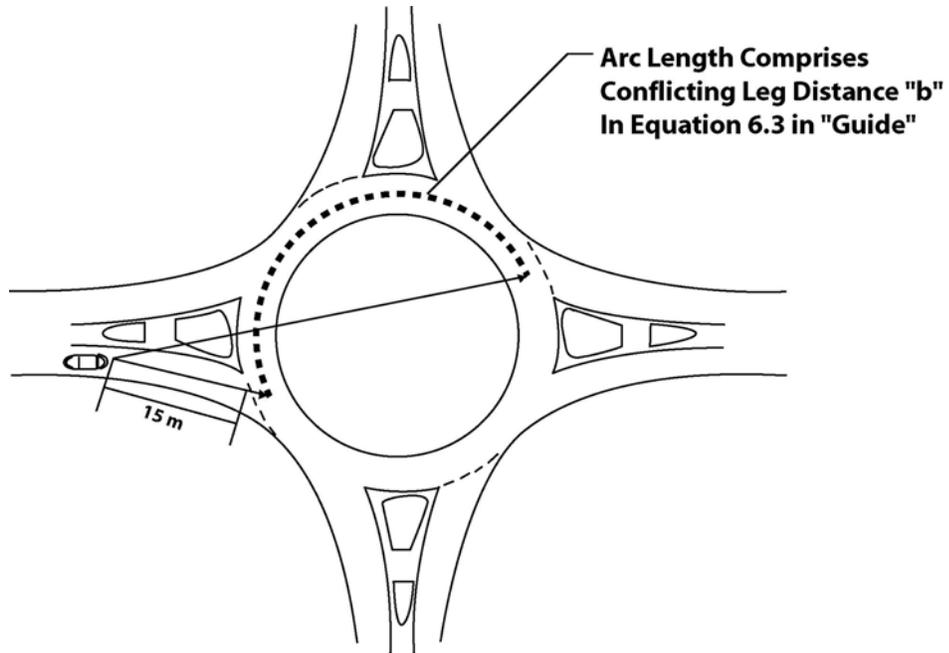


Figure 2
Entering Stream Conflicting Leg Distance “b”
Described in Equation 6.3 in the Guide

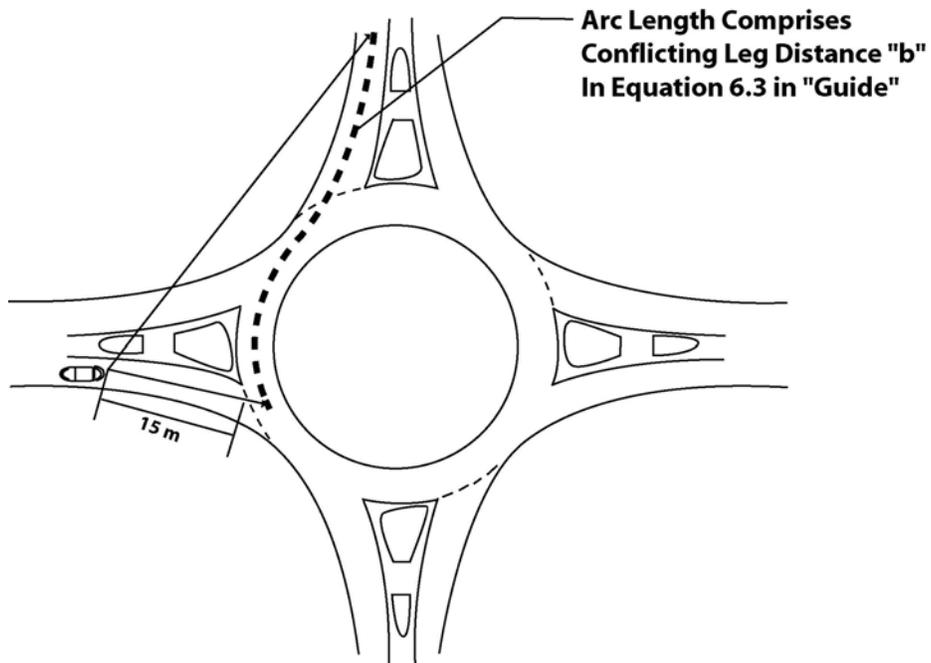
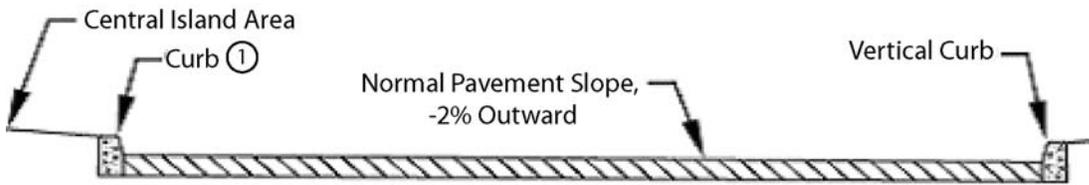
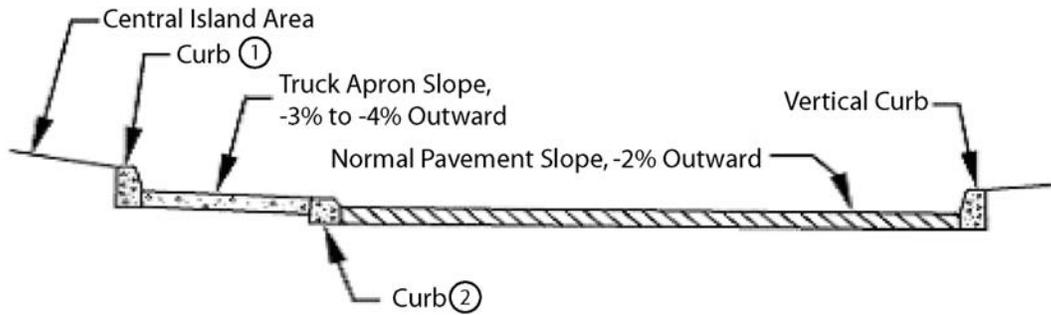


Figure 3
Typical Cross Sections for Circulatory Roadway



TYPICAL CROSS SECTION WITHOUT TRUCK APRON

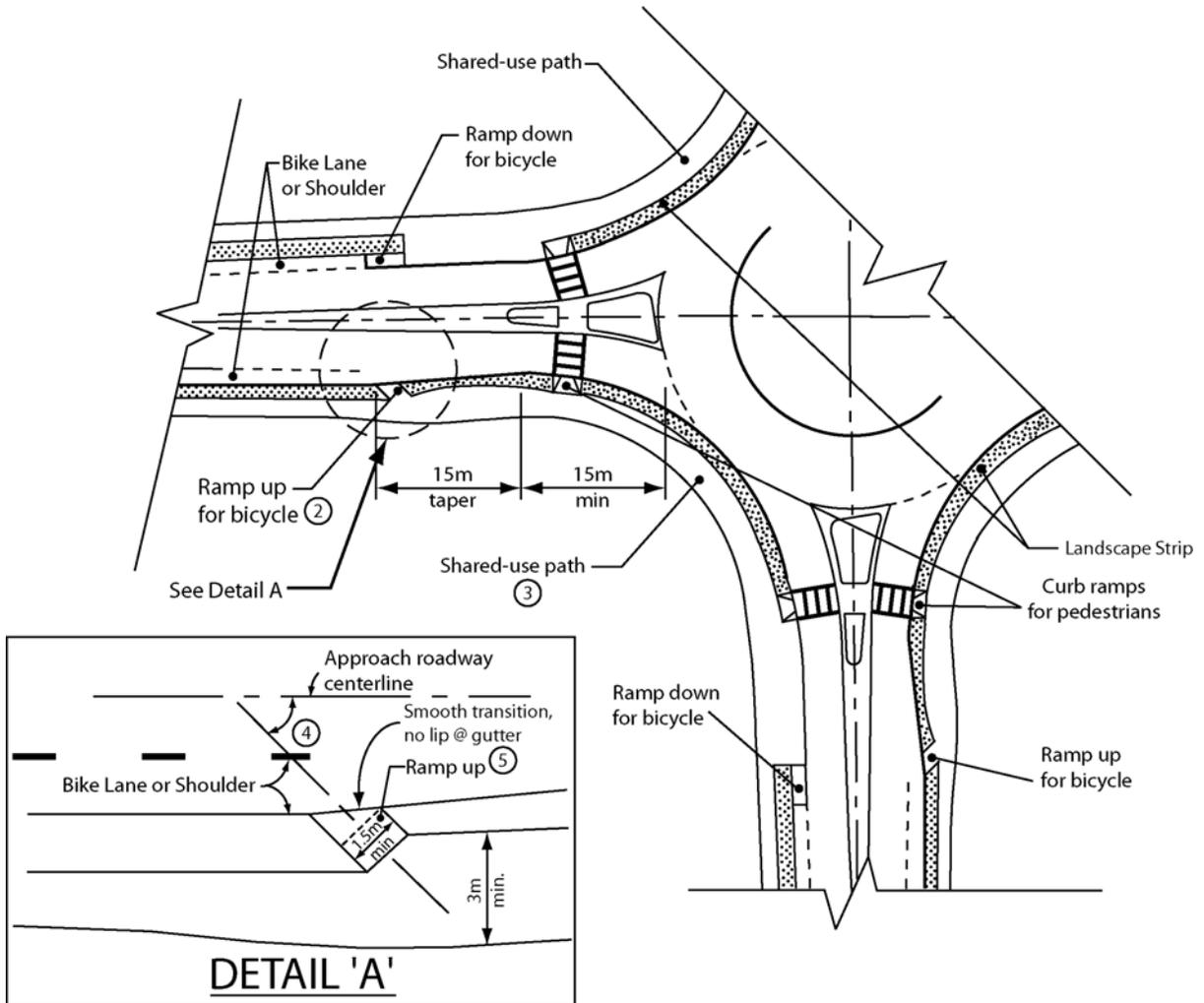


TYPICAL CROSS SECTION WITH TRUCK APRON

NOTES

- ① Vertical curb typical, except sloped curb for rural roundabouts with high speed approaches.
- ② Low vertical curb (75-100 mm with 1.5:1 sloped face or steeper) or high sloped curb (100-150 mm with 1:2 sloped face or flatter).

Figure 4
Bicycle Ramp Access to Shared-use Path ^①



NOTES

- ① Each roundabout intersection is unique and will require sound engineering judgement on the part of the designer as to the appropriate solution. These illustrations are only intended to show potential details that may be included in the design of a roundabout. For further guidance on how to comply with Departmental standards on landscaping, delineation, signing, pedestrian accessibility and accommodation per the Americans with Disability Act (ADA), and bicycle standards contact the Traffic Operations Liaison and the Design Coordinator.
- ② Ramps for bicyclists choosing not to proceed through the roundabout as a vehicle should be designed to provide adequate stopping sight distance for the bicyclists and, for the comfort of the pedestrians using the path, balance the bicyclists' desire to maintain momentum with the possibility that conflicts may occur with pedestrians.
- ③ Shared-use path will be used by both pedestrians and bicyclists and should be designed accordingly taking into account the unique behavior characteristics and needs of both types of users. For further discussion, see the Highway Design Manual and the AASHTO Guide for the Development of Bicycle Facilities, 1999.
- ④ The target value for this angle is 45° (30° minimum); however, the actual angle designed at a given entrance should take into consideration all of the users of the path.
- ⑤ Ramp up as necessary; should not exceed 15%. Round the landscape strip slopes to match the grade of the ramp. Curbs should not be placed between the landscape strip and the ramp.